Docket No. SA-537

Exhibit No. 2-M

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Operations Group Chairman Factual Report

Stall Protection Demonstration

(3 Pages)

Attachment 12

To Operations Group Factual Report

DCA13MA120

Stall Protection Demonstration

Do not change gear or flap configuration during the recovery, unless a stall warning indication is encountered during liftoff and the flaps were inadvertently positioned up for takeoff. In this case, extend flaps 1 as directed in the Approach to Stall or Stall Recovery maneuver. Extending or retracting the flaps during the recovery at other times results in an increased altitude loss.

High Altitude Recovery

At higher altitudes, normally above 20,000 feet, the airplane becomes increasingly thrust limited. If an approach to stall indication is experienced, nose down elevator is required to initiate a descent. This is because when the airplane is thrust limited, altitude needs to be traded for airspeed. Therefore a recovery at high altitude results in a greater altitude loss than a recovery at low altitudes.

Stall Protection Demonstration

The objective of the stall protection demonstration is to familiarize the pilot with stall warning and the correct recovery technique for conditions that are approaching stall, both with and without the autopilot.

Begin the stall protection demonstration in level flight with flaps up at flaps up maneuver speed. Select a speed in the IAS/MACH window that is below the minimum speed indication on the speed tape. Disengage the autopilot and autothrottle and retard the thrust levers to idle. As the speed decreases into the amber band, the PLI appears on the PFD. When the speed decreases approximately half way through the amber band, the AIRSPEED LOW caution message appears. The autothrottle wakes up, automatically engages in the SPD mode, and returns the airplane to the minimum maneuver speed.

For the second part of the stall protection demonstration, select VREF 30 on the CDU. Disengage the autopilot, turn the autothrottle arm switches off, and select a speed in the IAS/MACH window that is below the minimum speed indication on the speed tape. Maintain heading and altitude, and retard the thrust levers to idle. As the airplane decelerates, continue trimming and select flaps 20 on schedule. The PLI appears on the PFD when the flaps are extended. The airplane can be trimmed until the airspeed is approximately equal to the minimum maneuver speed. Below this airspeed, nose up trim is inhibited. After the airspeed decreases into the amber band, use only control column inputs to maintain level flight. The stick shaker activates at minimum speed. If the airspeed reduces to slightly less than minimum speed, increased control column force is required to maintain level flight. Recover from the approach to stall in accordance with the Approach to Stall or Stall Recovery maneuver. Lateral control is maintained with ailerons and spoilers. Rudder use is not recommended because it causes yaw and the resultant roll is undesirable. After recovery, accelerate to flaps up maneuver speed while retracting the flaps.

To demonstrate autopilot stall protection, ensure that the pitch mode is ALT, turn the autothrottle arm switches OFF and then retard thrust levers to idle. As the speed approaches the minimum speed, the AUTOPILOT caution message appears, an amber line is drawn through the selected pitch mode and the flight director pitch bar is removed. At minimum speed, the stick shaker activates. Shortly after the stick shaker activates, the autopilot begins to descend from the selected altitude. The autopilot maintains a descent at a speed that is slightly above the minimum speed. To recover, engage the autothrottle with a higher speed selected or manually advance the thrust levers. Select a new pitch mode or disengage the autopilot and manually fly the airplane back to the starting altitude.

Bank Angle Protection

The objective of the turn maneuver is to familiarize the pilot with airplane handling characteristics beyond 35° of bank. During training, up to 45° of bank may be used for this maneuver. It is not intended that the pilot should ever be required to bank greater than 25° to 30° in any normal or non-normal condition.

With the autopilot OFF, initiate a turn beyond 35° of bank. Note that at approximately 35° of bank, the protection system provides opposing forces to the control wheel and that the PFD bank indicator turns amber. The protection forces can be overridden by the pilot and maximum control wheel deflection always commands maximum control surface deflection. Release the roll input and the protection system returns the airplane back to 30° of bank or less and the bank indicator returns to white.

Note: When flying with bank angle more than 30° the pilot must add control column back pressure to maintain level flight.

Terrain Avoidance

The Ground Proximity Warning System (GPWS) PULL UP Warning occurs when an unsafe distance or closure rate is detected with terrain below the airplane. The Look-ahead terrain alerting (as installed) also provides an aural warning when an unsafe distance is detected from terrain ahead of the airplane. Immediately accomplish the Terrain Avoidance maneuver found in the non-normal maneuvers section in the QRH.

Do not attempt to engage the autopilot and/or autothrottle until terrain clearance is assured.

Terrain Avoidance - RNAV (RNP) AR Operations

Appendix A.2.10